Application No.: 09/902,094   Docket No.: 8827.012.00-US
Amendment filed on February 3, 2005
Reply to Office Action dated November 3, 2004

AMENDMENTS TO THE CLAIMS:

1. (Currently Amended) A system for early warning in an e-service management system,
comprising:

a statistical learning mechanism for performing statistical learning based on a plurality of
data values of a variable to generate a statistical model characterizing the behavior of the
variable;

an early warning mechanism for generating an early warning of threshold violation of the
variable with respect to a threshold by predicting, based on <u>a plurality of residuals corresponding</u>
<u>to different time reference points in the future based on the statistical model,</u> ~~the statistical~~
~~model,~~ a future time by which the values of the variable exceeds the threshold; and

an operational mechanism for detecting abnormal behavior of the variable based on both
the statistical model and the early warning.

2. (Previously Presented) The system according to claim 1, wherein the statistical
learning mechanism comprises:

an offline normal behavior modeling mechanism for modeling the regular behavior of the
variable based on the plurality of values of the variable collected offline over a period of time;
and

an online behavior modeling mechanism for modeling the dynamic behavior of the
variable based on a plurality of values of the variable collected online during the operations
performed by the operational mechanism.

3. (Currently Amended) A method for early warning in an e-service management system,
comprising:

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modeling the behavior of a variable based on a plurality of data values of the variable

collected over a period of time, said modeling being performed based on the statistical properties

of the data values of the variable to generate a behavior model for the variable, the behavior

model being represented using a plurality of model parameters;

generating an early warning for a threshold violation of the variable with respect to a

threshold based on a plurality of data values of the variable collected online and the behavior

model, the generating an early warning including computing a plurality of residuals

corresponding to different time reference points in the future based on the model parameters; and

detecting abnormal behavior of the variable according to the plurality of data values of

the variable collected online and the early warning.

4. (Original) The method according to claim 3, wherein the modeling comprises:

establishing, by an offline normal behavior modeling mechanism, a first statistical model

that characterizes the regular behavior of the variable based on a first set of values of the variable

collected offline over a period of time; and

establishing a second statistical model that characterizes the dynamic behavior of the

variable based on a second set of values of said variable collected online, said first and said

second statistical model comprising said behavior model.

5. (Currently Amended) The method according to claim 3, wherein generating an early

warning further includes comprises:

computing a plurality of residuals at corresponding different time reference points in the

future based on the model parameters;

deriving the variances of the plurality of residuals, predicted by said predicting;

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estimating the probabilities for threshold violation of the variable with respect to said

threshold at the corresponding different time reference points in the future; and

issuing an early warning for any of the time reference points at which the probability for

threshold violation of the variable exceeds a pre-determined value.

6. (Currently Amended) The method according to claim 5, wherein the estimating the

probabilities comprises:

~~translating the threshold for the variable to corresponding~~ deriving a residual threshold

[[for]] corresponding to the residual of the variable; and

calculating the probabilities for threshold violation of the residual with respect to the

residual threshold at the corresponding different time reference points in the future.

7. (Currently Amended) A computer-readable medium encoded with a program for early

warning in an e-service management system, the program comprising:

modeling the behavior of a variable based on a plurality of data values of the variable

collected over a period of time, said modeling being performed based on the statistical properties

of the data values of the variable to generate a behavior model for the variable, the behavior

model being represented using a plurality of model parameters;

generating an early warning for a threshold violation of the variable with respect to a

threshold based on a plurality of data values of the variable collected online and the behavior

model, the generating an early warning including computing a plurality of residuals

corresponding to different time reference points in the future based on the model parameters; and

detecting abnormal behavior of the variable according to the plurality of data values of

the variable collected online and the early warning.

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8. (Original) The medium according to claim 7, wherein the modeling comprises:

establishing, by an offline normal behavior modeling mechanism, a first statistical model that characterizes the regular behavior of the variable based on a first set of values of the variable collected offline over a period of time; and

establishing a second statistical model that characterizes the dynamic behavior of the variable based on a second set of values of said variable collected online, said first and said second statistical model comprising said behavior model.

9. (Currently Amended) The medium according to claim 7, wherein generating an early warning further includes comprises:

computing a plurality of residuals corresponding to different time reference points in the future based on the model parameters;

deriving the variances of the plurality of residuals, predicted by said predicting;

estimating the probabilities for threshold violation of the variable with respect to said threshold at the corresponding different time reference points in the future; and

issuing an early warning for any of the time reference points at which the probability for threshold violation of the variable exceeds a pre-determined value.

10. (Currently Amended) The medium according to claim 9, wherein the estimating the probabilities comprises:

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~~translating the threshold for the variable to corresponding~~ deriving a residual threshold

[[for]] corresponding to the residual of the variable; and

calculating the probabilities for threshold violation of the residual with respect to the

residual threshold at the corresponding different time reference points in the future.

11. (Previously Presented) The system as claimed in claim 1, wherein the thresholds

corresponding to future times are distinct based on time of day and day of week.

12. (Previously Presented) The system as claimed in claim 1, wherein the detection of

abnormal behavior is further based on criteria derived from a business process model.

13. (Previously Presented) The system as claimed in claim 2, wherein the online behavior

modeling mechanism includes a sliding window.

14. (Currently Amended) The system as claimed in claim 13, wherein the sliding window

is used to determine ~~stationarity~~ segments in which the variable includes stochastically stationary

behavior ~~segments of the variable~~ and the times corresponding to boundaries of the ~~stationarity~~

stationary segments.

15. (Previously Presented) The system as claimed in claim 13, wherein the width of the

sliding window is configurable parameter.

16. (Currently Amended) The method as claimed in claim 3, wherein the modeling of the

behavior of the variable includes detecting time segments in which the variable includes

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stochastically stationary behavior ~~segments of stationarity~~ and the times corresponding to the

boundaries of <u>the time</u> ~~these stationarity~~ segments.

17. (Previously Presented) The method as claimed in claim 3, wherein detecting

abnormal behavior of the variable is further according to criteria derived from a business process

model.

18. (Previously Presented) The method as claimed in claim 5, wherein the residuals

corresponding to different time points in the future comprise a distinct value depending on the

time of day, day of week, and week of month of the future time.

19. (Previously Presented) The method as claimed in claim 5, wherein the number of time

reference points and the pre-determined threshold violation value are configurable parameters.

20. (Previously Presented) The method as claimed in claim 5, wherein the number of time

reference points and the pre-determined threshold violation value are derived from a business

process model.

21. (Previously Presented) The computer-readable medium as claimed in claim 7,

wherein the threshold is further based on criteria derived from a business process model.

22. (Previously Presented) The computer-readable medium as claimed in claim 7,

wherein the threshold is a distinct value based on time of day and day of week.

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23. (Currently Amended) The computer-readable medium as claimed in claim 8, wherein

the modeling of the behavior of the variable includes detecting time segments <u>in which the</u>

<u>variable includes stochastically stationary behavior</u> ~~of stationarity~~ and the times corresponding to

the boundaries of [[these]] <u>the time</u> ~~stationarity~~ segments.

24. (Previously Presented) The computer-readable medium as claimed in claim 8,

wherein modeling of the behavior of the variable includes the use of a sliding window.